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INTELLIGENT CONFIGURATION SERVER

This application is a continuation of co-pending application 09/320,062 which is a continuation in-part of co-pending application serial number 09/048,917 filed March 26, 1998 which is a continuation of Patent 5,734,705 which issued March 3, 1998.

Background of the Invention:

This invention relates generally to a Private Branch Exchange (PBX) and more particularly to an intelligent configuration server that automatically initializes a call accounting system which generates reports from PBX call detail record output data.

Phone calls from a PBX system are tracked and reported using call accounting programs. The accounting program reads Call Detail Recording (CDR) messages alternatively referred to as Station Message Detail Recording (SMDR) messages which are output from the PBX. A PBX output port, usually comprising an RS-232 receptacle, outputs the CDR messages. The accounting program is loaded onto a personal computer (PC) and the PC is connected directly into the RS-232 receptacle on the PBX or through an inline intermediate storage device, or via a dial-up modem.

The CDR messages output from the PBX output port contain information about each telephone call processed by the PBX. The call accounting program

1 reformats the CDR messages into sophisticated tracking reports. For example,
2 the accounting program can reformat the CDR messages into lists identifying
3 telephone calls according to business department, telephone extension or by
4 time of day. Different PBX manufacturers and even different PBX models from
5 the same manufacturer may generate different CDR message formats.
6 Therefore, in order to accurately decipher CDR messages, accounting programs
7 must be configured specifically for the PBX type.

8
9 A rate table is a database that contains the cost of calls, for example, referenced
10 to different parameters such as country codes, city codes, area codes and
11 exchange based on the number dialed plus certain time-of-day considerations.
12 Typically, rate tables are manually loaded into the PC running the accounting
13 program via floppy disk. The rate tables are periodically updated, again via
14 floppy disk, to reflect changes in phone tariffs.

15 Typically, call accounting programs require a local PBX technician to identify the
16 PBX manufacturer and PBX model number as part of the sales order or part of
17 the installation procedure. The call accounting program is either hard-coded to
18 support the specific PBX type or shipped with pre-configured tables that support
19 known PBX types. If the PBX type and model number are unknown to the local
20 PBX technician or if the PBX type is not one of the PBX types hard-coded into
21 the call accounting software, the accounting program cannot generate reports
22 from the PBX.

23

Rate tables are typically manually loaded into the PC running the accounting program. Rate tables vary according to location of the PBX (area code and exchange) or vary according to country codes and city codes. Therefore, a different rate table is required for each accounting program or for each site configuration within the program which is operating in a different Local Exchange Carrier's rate center. There are over 15,000 rate centers in the U.S. Presently, the different rate tables are copied onto floppy disks and sent to each local PC software operator. The software operator then manually copies the contents of the floppy disk into the PC running the accounting program. Tariffs and numbering plans for telephone calls frequently change. Thus, rate tables must be constantly updated in each PBX accounting program. Manually tracking the appropriate rate table for each accounting program and then periodically mailing updated rate tables to each customer is time-consuming, expensive and prone to mishandling resulting in magnetic media damage.

Accordingly, a need remains for automatically reconfiguring an accounting program to run with different PBX types and CDR software package updates on a PBX, automatically updating program rate tables for each accounting program and increasing security for proprietary software used in the accounting program.

Summary of the Invention:

An intelligent configuration server analyzes sample CDR messages from different PBXs. A sample CDR message from a PBX is transmitted to the

1 central configuration server via a standard dial-up modem. The configuration
2 server determines the actual PBX type by comparing the sample CDR message
3 with known CDR message streams previously stored in server memory.

4
5 If the PBX type is identified, a corresponding PBX interface file is transmitted
6 from the configuration server back to a local PC connected to the PBX. The
7 PBX interface file is used by the PC accounting program to identify the correct
8 format for CDR messages output from the PBX. The accounting program can
9 then correctly interpret the CDR messages output from the PBX into call reports.

10 If a sample set of CDR messages is not recognized by the configuration server,
11 a message is transmitted to the local PC software operator and to a customer
12 service operator maintaining the configuration server.

13
14 The configuration server downloads rate tables via modem to the local PBX.

15 The PC call accounting software automatically sends identification (ID) and
16 location data to the configuration server. The ID and location data includes the
17 name, address, area code and exchange for the local PBX. The configuration
18 server uses the ID and location data to identify the appropriate rate table for the
19 local PBX. The rate table is then automatically downloaded from the
20 configuration server to the local PC for use with the accounting program.

21
22 Each remote PC software operator can manually request rate table updates at
23 any time from the configuration server or schedule the downloads to take place

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1 automatically on a periodic basis. Thus, operator interaction is not required to
2 maintain up-to-date tariffs in customers' call accounting programs.

3
4 CDR message analysis and rate table assembly is performed at one central
5 configuration server location. Security of proprietary CDR message analysis
6 software is increased since analysis software is not distributed to end users. The
7 time and cost of distributing, tracking and updating rate tables for each customer
8 is decreased since rate tables are automatically sent via modem from a central
9 server. Repeated end-user training due to personnel changes is reduced and
10 system accuracy improved through the automation of this process.

11
12 The foregoing and other objects, features and advantages of the invention will
13 become more readily apparent from the following detailed description of a
14 preferred embodiment of the invention which proceeds with reference to the
15 accompanying drawings.

16
17 **Brief Description of Drawings:**

18 FIG. 1 is a diagram of an intelligent configuration system according to the
19 invention.

20
21 FIG. 2 is a detailed diagram of the intelligent configura-tion system shown in FIG.
22 1.

23

1 FIG. 3 is a step diagram showing a method for installing and operating the
2 intelligent configuration system shown in FIG. 1.

3

4 **Detailed Description of the Invention:**

5 FIG. 1 is a schematic diagram of an intelligent configuration system 12 according
6 to the invention. A configuration server 14 is located at a central system support
7 location and is coupled to a modem 16. One example of a configuration server
8 14 is a PC workstation attached to a Novell Netware 3.12 version server.

9 However, any computer capable of receiving, sending and processing data in a
10 manner described below can be utilized. For example, in another embodiment
11 of the invention, a stand-alone call accounting system is used independently of
12 the PC environment and comprises special hardware including a processor and
13 memory for storing call records and rate tables, etc.

14

15 PBXs 22A, 22B and 22C each support a separate telephone network at different
16 locations and are any of a large number of commercially available PBX systems
17 well-known to those skilled in the industry. Each PBX 22A-22C is coupled to a
18 local personal computer (PC) 20A-20C, respectively. Modems 18AB18C are
19 connected to each local PC 20A-20C, respectively, and provide electronic data
20 communication between the local PCs 20A-20C and configuration server 14 via
21 modem 16.

22

23 The transmission of rate tables and configuration data between the configuration

10039928-102901

1 server and the host PC can be conducted by means other than an analog
2 modem. In one embodiment, data is transmitted over a digital network, such as
3 ISDN through a terminal adapter.

4
5 FIG. 2 is a detailed diagram of both the configuration server 14 and one of the
6 local PCs 20A shown in FIG. 1. Local PCs 20B and 20C operate in a similar
7 manner to PC 20A described below. The configuration server 14 includes a
8 processor 15 connected to a memory 17. Memory 17 contains three databases.

9 A PBX database includes PBX interface files containing information on different
10 PBX types supported by the intelligent configuration system 12. For example,
11 the PBX interface files may describe distinguishing characteristics of CDR
12 message strings output by particular PBX types and identifies the appropriate
13 translation routine used by the accounting program to interpret and price the
14 CDR messages.

15
16 A rate table database contains rate tables for different telephone parameters
17 such as area codes and exchanges or country codes and city codes instead of
18 area codes and exchanges and multiple service providers. The rate tables
19 contain tariff information for local and long distance telephone calls made
20 through different telephone companies according to the day of the week and the
21 time of the day. A customer database contains customer files for each
22 accounting program supported by the intelligent configuration system 12.

23

1 Local PC 20A includes a processor 19 coupled to a memory 21. The memory 21
2 stores the accounting program, a rate table corresponding with the local PBX
3 area code, a PBX interface file and ID and location data. The accounting
4 program is used by processor 19 to generate telephone accounting reports and
5 the rate table is used by the accounting program for cost analysis and traffic
6 engineering analysis. The PBX interface file is used by the accounting program
7 to identify the CDR message format output from the PBX. The ID and location
8 data are transmitted to the configuration server 14 for referencing the
9 appropriate customer file in memory 17.

10
11 The processor 19 receives ID and location data through a keyboard input 26 or
12 automatically from the installation floppy diskette, and CDR messages from PBX
13 22A through an RS-232 input 24. The processor 19 transmits via modem 18A
14 (FIG. 1) the PBX ID and location data and sample CDR messages 23 to
15 processor 15. Processor 15 uses the CDR and location data 23 to identify the
16 correct PBX interface file and rate table 25 for transmitting back to processor 18.

17
18
19 Referring to FIG. 3, the intelligent configuration system 12 operates in the
20 following manner. For simplicity, operation is referenced only to local PC 20A.
21 Local PCs 20B and 20C operate in a similar manner. Local PC 20A is
22 connected through RS-232 port 24 (FIG. 2) to the PBX 22A in step 34 and local
23 PC 20A actuated in step 36. A PBX operator in step 38 inputs ID and location

data via the keyboard input 26 (FIG. 2) into local PC 20A. Step 40 sends the ID and location data to the configuration server 14 via modems 18A and 16 (FIG. 1).

In step 42, the local PC 20A reads a set of sample CDR messages from the PBX 22A and step 44 transfers the sample CDR messages to configuration server 14. Step 46 analyzes the sample CDR messages in the configuration server 14 to determine the PBX type. The configuration server 14 matches the sample CDR messages sent from local PC 20A by identifying unique message characteristics described in a PBX description file stored in memory 17 (FIG. 2) for known PBX types.

The example below shows sample SMDR records output from different PBX units.

EXAMPLE #1

Sample SMDR Records:

| | | | | | | |
|-------------|------------|------|------|--------------------|------|--------|
| 08/03 07:59 | 0000:01:34 | 2630 | | 121233380402542630 | X143 | |
| 08/03 07:59 | 0000:02:02 | 2502 | | 161096233332542502 | X142 | |
| 08/03 08:01 | 0000:00:14 | X124 | 004 | 4506 1111 | | 3101 |
| 08/03 08:01 | 0000:00:30 | 4801 | | 52010732544801 | X146 | |
| 08/03 08:02 | 0000:00:18 | 4352 | | 140439756432544352 | X147 | |
| 08/03 08:03 | 0000:00:14 | X122 | 004 | 4506 1111 | | 2208 |
| 08/03 08:02 | 0000:02:52 | | X123 | 004 1111 | | 3102 |
| 08/03 08:02 | 0000:02:20 | | X124 | 004 1111 | | 3103 |
| 08/03 08:05 | 0000:00:10 | 2630 | | 130554669082542630 | X148 | |
| 08/03 08:05 | 0000:00:21 | X124 | 004 | 1111 | | 2101 |
| 08/03 08:05 | 0000:00:07 | X147 | *** | 9 | | T |
| 08/03 08:05 | 0000:00:14 | X124 | 005 | 4506 1111 | | 2103 |
| 08/03 08:06 | 0000:00:11 | 4352 | | 18006944997 | | T4 |
| 08/03 08:05 | 0000:01:08 | 4722 | | 18008762722 | | T3 |
| 08/03 08:05 | 0000:01:12 | X148 | 004 | 1111 | | 2104 |
| 08/03 08:06 | 0000:00:30 | X124 | 005 | 1111 | | 3102 |
| 08/03 08:04 | 0000:02:44 | X209 | 001 | 2937 | | 2937 |
| 08/03 08:04 | 0000:02:51 | 4353 | | 2732937 | | T1 |
| 08/03 08:07 | 0000:00:05 | X205 | 023 | 2958 | | T 3364 |

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PBX Analysis Match:

Switch Type mitel
Description MITEL SX100/SX200 - MITL9105/9110-097-451NA-AUG81
Call Type Outgoing
Record Type T|X|A 62..62
Date mm/dd 2..6
Time hh:mm 8..12
Duration hh:mm:ss 15.22

Switch Type mitel
Description MITEL SX100/SX200 - MITL9105/9110-097-451NA-AUG81
Call Type Incoming
Record Type T|X|A 24..24
Date mm/dd 2..6
Time hh:mm 8..12
Duration hh:mm:ss 15.22

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T0620T" B265E00T

EXAMPLE #2Sample SMDR Records:

N 059 00 T004001 DN7309 09/15 08:20 00:05:48
 0000 0000
 D 060 00 T004001 DN7309 09/15 08:26 00:05:48
 S 061 00 T004001 DN8091 09/15 08:26 00:00:06
 0000 0000
 N 062 00 DN7200 T002008 016.0.00.10 09/15 08:26 00:00:40 A 800215104166242
 0000 0000
 N 063 00 T004002 DN7133 014.0.00.14 09/15 08:27 00:00:02
 0000 0000
 N 064 00 DN7394 T002007 09/15 08:26 00:00:54 A 80214042307088
 0000 0000
 N 065 00 DN7262 T002009 023.0.00.02 09/15 08:26 00:03:02 A 800212092231660
 0000 0000

PBX Analysis Match:

Switch Type nt_tenan
 Description NT MERIDIAN 1 -- MULTI-TENANT CODE
 Call Type Incoming
 Record Type (N|S|E)&T 1..1&10..10
 Date mm/dd 38..42
 Time hh:mm 44..48
 Duration hh:mm:ss 50..57
 Switch Type nt_tenan
 Description NT MERIDIAN 1 -- MULTI-TENANT CODE
 Call Type Outgoing
 Record Type (N|S|E)&T 1..1&18..18
 Date mm/dd 38..42
 Time hh:mm 44..48
 Duration hh:mm:ss 50..57
 Digits (A y*) 59..80
 Switch Type nt_tenan
 Description NT MERIDIAN 1 -- MULTI-TENANT CODE
 Call Type TENANT
 Record Type 00&00 10.11&18..19

EXAMPLE #3Sample SMDR Records:

| | | | | |
|------------------|----------------|-----|--------|----|
| 0952 0001 7 9 83 | 886819 | 722 | 6 0 | 15 |
| 0952 0002 7 9 83 | 18002359216 | 702 | 7 0 | 03 |
| 0952 0017 0 | 785 | 301 | | |
| 0952 0021 9 | 799 | 83 | 7 0 02 | |
| 0952 0045 7 9 83 | 7543788 | 706 | 6 0 | 08 |
| 0953 0004 7 9 80 | 0118525294118# | 371 | 7 0 | 14 |
| 0953 0062 9 | 799 | 80 | 7 0 06 | |
| 0953 0000 7 9 83 | 886819 | 722 | 6 0 | 09 |
| 0954 0188 9 | 788 | 84 | 7 0 04 | |
| 0954 0001 0 | 740 | 302 | | |
| 0954 0011 9 | 799 | 83 | 7 0 02 | |

| | | | | | |
|----|------------------|----------------|-----|--------|----|
| 1 | 0954 0005 0 | 771 | 302 | | |
| 2 | 0954 0015 7 9 83 | 5965433 | 705 | 6 0 | 12 |
| 3 | 0954 0020 9 | 754 | 84 | 7 0 05 | |
| 4 | 0955 0004 7 9 80 | 0118525294118# | 371 | 7 0 | 12 |
| 5 | 0955 0067 7 9 83 | 5719330 | 343 | 6 0 | 07 |
| 6 | 0956 0002 7 9 83 | 2778194 | 310 | 6 0 | 15 |
| 7 | 0956 0005 7 9 83 | 2700535 | 771 | 7 0 | 14 |
| 8 | 0956 0038 7 9 83 | 6680264 | 312 | 7 0 | 10 |
| 9 | 0956 0034 9 | 799 | 80 | 7 0 16 | |
| 10 | 0956 0001 0 | 312 | 301 | | |
| 11 | 0957 0001 7 9 83 | 2767255 | 771 | 7 0 | 11 |
| 12 | 0957 0015 9 | 799 | 83 | 7 0 02 | |
| 13 | 0957 0009 7 9 83 | 3588000799 | 792 | 7 0 | 13 |
| 14 | 0957 0007 7 9 83 | 411 | 788 | 6 0 | 12 |
| 15 | 0957 0004 7 9 80 | 0118525294118# | 371 | 7 0 | 10 |
| 16 | 0957 0003 9 | 794 | 84 | 7 0 07 | |

PBX Analysis Match:

| | | |
|----|-------------|------------------|
| 21 | Switch Type | att75v3 |
| 22 | Description | AT&T SYS 75 R1V3 |
| 23 | Call Type | Incoming |
| 24 | Record Type | 9 11..11 |
| 25 | Date | |
| 26 | Time | hhmm 1..4 |
| 27 | Duration | hmm 6..9 |
| 28 | Extension | x+ 32..35 |
| 29 | | |
| 30 | Switch Type | att75v3 |
| 31 | Description | AT&T SYS 75 R1V3 |
| 32 | Call Type | Outgoing |
| 33 | Record Type | 1 7 A C 11.11 |
| 34 | Date | |
| 35 | Time | hhmm 1..4 |
| 36 | Duration | hmm 6..9 |
| 37 | Extension | x+ 38..41 |
| 38 | Digits | y+ 21..35 |

The configuration server 14 recognizes PBX types by matching the characteristics, such as record format, (other options are possible for other PBXs) with previously stored samples. As shown in the examples above, each of the three PBX units outputs a different SMDR record format. The configuration server 14 can accordingly identify the SMDR report type according to the specific format characteristics.

Each sample contains a default of 4000 characters or approximately 45 call records, depending on the CDR record length. A predetermined number of

1 matches to the same PBX type is required before a match is considered
2 complete. Each CDR message in the sample uploaded to the configuration
3 server is evaluated against all stored PBX types.

4
5 Step 48 downloads the appropriate PBX interface file for the identified PBX type
6 to local PC 20A. Failure to recognize a PBX type results in the configuration
7 server 14 sending a message to local PC 20A as well as to customer service
8 personnel operating the configuration server 14. The pattern matching program
9 used by the configuration server 14 can be modified by a technician to add or
10 change PBX recognition criteria. The sample CDR messages received from
11 local PC 20A are preserved in memory on the configuration server 14 as PC files
12 identified by the customer ID.

13
14 Step 50 downloads a rate table from the configuration server 14 to local PC 20A.
15 The configuration server 14 uses the ID and location data (e.g., area code)
16 transmitted in step 40 to locate the appropriate rate table for PBX 22A. Step 52
17 uses the downloaded PBX interface file and the downloaded
18 rate table to generate accounting reports from the CDR messages output from
19 PBX 22A.

20
21 The PBX operator can manually request rate table updates at any time or
22 schedule the downloads to take place on a periodic basis. Decision step 54
23 monitors either a manual keyboard request or a preprogrammed periodic request

1 for updating the rate table. When a manual or an automatic update request is
2 made by the local PC 20A, decision step 54 jumps to step 50. The configuration
3 server 14 then searches the customer database for the name of the rate table
4 file of the local PC requesting the update. The configuration server locates the
5 appropriate rate table and then sends the rate table to local PC 20A.

6 Subsequent telephone reports generated in step 52 use the updated rate table
7 transmitted in step 50.

8
9 Each session between the local PC 20A to the configuration server 14 is initiated
10 with a unique serial number. The configuration server 14 verifies the serial
11 number and the command in the customer database. If the serial number is not
12 in the database or has already been registered, communication between the
13 local PC 20A and configuration server 14 is terminated. Thus, the configuration
14 server 14, without operator intervention, constantly monitors which accounting
15 programs are initialized and when each accounting program requests a rate
16 table update.

17
18 It should be noted that other embodiments of the system also come within the
19 scope of the invention. For example, the entire system including the local PC
20 and the configuration server can be contained within a single stand-alone PC
21 which stores sample SMDR reports, rate tables, etc., performs the functions of
22 configuration server 14 and local PC 20.

23

1 Many other alternative embodiments of the invention are possible. For example,
2 alternative embodiments of the invention can include systems wherein the PBX
3 system shown herein is replaced by a different communication system that
4 serves to connect two endpoints for voice or data communications and
5 messaging. For example the PBX system shown herein can be replaces by
6 other communication systems such as WAN (Wide Area Network) access,
7 Internet web access, by e-mail access, video conferencing, fax, chat messaging,
8 ftp sessions, telnet sessions, Voice over IP (VoIP), Fax over IP, etc.

9
10 In still other alternative embodiments the CDR messages shown herein can be
11 replaced by other messaging systems that serve as audit trails to
12 communications and message transactions including traffic/usage messages
13 from firewalls, routers, bridges, gateways, LAN-PBX, IP-PBX, PC-PBX, HTTP
14 servers, SMTP servers or VPN devices. In such alternative embodiments, such
15 other messaging systems are equivalent to the CDR messaging system shown
16 herein.

17
18 In still other alternative embodiments of the invention, the rate tables shown
19 herein can be replaced by other criteria for billing based on network usage
20 including IP packet count, byte or octet count, hours, minutes, seconds, sub-
21 second measurements. In such alternative embodiments, such alternative
22 criteria for billing are equivalent to the rate tables shown herein.

23

1 In still other alternative embodiments, other communication devices in addition to
2 modems can be used to establish a connection to the Configuration Server.
3 Such alternative communication devices include, TCP/IP sockets, ftp sessions,
4 telnet sessions.

5
6 Having described and illustrated the principles of the invention in a preferred
7 embodiment thereof, it should be apparent that the invention can be modified in
8 arrangement and detail without departing from such principles. We claim all
9 modifications and variation coming within the spirit and scope of the following
10 claims. For example, the invention could be used in an environment where one
11 PC monitors the performance of many PBX's. In such a situation, the PC could
12 have an internal buffer that stores CDX messages until retrieved by the PC.